FRACTURE OF THE FEMUR

BORCK.

EET, ROOMS 2 AND 3,
M. to 4 P. M.

Edw. Borck, M. D.,

3613 North Ninth Street, near Salisbury,

St. Louis. Mo.

St Louis Mo June 12. 79
3613 F. 9th St

Surgeon Genl U. S. Army
Major Genl Barnes M. D.
Washington D. C.

Dear Sir!

I take pleasure
in sending you a copy
of my monograph
"Fracture of the Femur"
for your inspection and judgment.
If it meets your approval
I will send to you,
or distribute as many
copies as you may require
as a compliment to the Medical
staff of U. S. Army.

I have the honor to be
Your Obedient Servant
Edw! Bock M.D.

ON

FRACTURE OF THE FEMUR.

BY

EDWARD BORCK, M. D.,

MEMBER OF THE MEDICAL AND CHIRURGICAL FACULTY OF MARYLAND
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ASS.; TRI-STATE MED. SOC.; FORMERLY ASST. SURG. TO
WEST BUILDING HOSPITAL, BALTIMORE, MD.,
AND LATE SURG. U. S. VOL.

WITH ILLUSTRATIONS.

SAINT LOUIS:
GEO. O. RUMBOLD & CO.
1879.

TO

E. H. GREGORY, M. D.,

PROFESSOR OF SURGERY, ST. LOUIS MEDICAL COLLEGE,

THIS

MONOGRAPH

IS CORDIALLY INSCRIBED

AS A

TRIBUTE OF HIGH PERSONAL ESTEEM,

AND A MARK OF RESPECT FOR HIS PROFESSIONAL

DEVOTION,

BY THE AUTHOR.

PREFACE.

In offering this little monograph to the profession, as a second edition, under the title of "Fracture of the Femur," the author felt himself persuaded to do so on account of the many inquiries and numerous applications that he has received from various parts of the country, for reprints of the articles appearing in the *St. Louis Medical and Surgical Journal.*

The first, "The Treatment of Fracture of the Femur," January, 1878; the second, "Review on the Treatment of Fracture of the Femur," March, 1878, and copied in the *Southern Medical Journal*, Atlanta, Ga., June 20, 1878—as well as many notices and compliments from the profession. In gratitude thereof he has combined the two under the above title, with slight changes, and some, it is to be hoped, profitable additions, including fourteen wood-cuts.

The first part describes the author's method, the second, is a review.

The remarks of Drs. Trader, Broome and Lankford were furnished by themselves.

Respectfully,

EDW. BORCK, M. D.,
3613 N. NINTH ST.,
ST. LOUIS, MO.

Fig. 1.

Dr. Borck's Method.

CHAPTER I.

THE TREATMENT

OF

FRACTURE OF THE FEMUR.

We possess many apparatuses and contrivances for fracture of the femur, and while there are so many it shows that there are none as yet perfect. Each of them has advantages and disadvantages more or less; but I think, that of all, the straight splints are the least useful and are unnatural. Look at the long splints, Munger's, Walton's, Liston's, Physick's, Hamilton's, Desault's, Hodge's and Gilbert's apparatus, and many more, there is not one that is comfortable to the patient. They all look more like torture machines.

Morgan's fracture bed, Swinburne's method, and Buck's apparatus are preferable to the long splints; they all aim at keeping the limb straight and preventing shortening by extension and counter extension. The patient is kept flat on his back, shoulders low, perineal band, extension, by the foot and leg in various ways. The knee can only bear from fifteen to

twenty pounds of extension weight by the leg, hardly enough to overcome the rigidity of the muscles of the thigh, while the bandages upon the leg and foot will irritate the skin; the perineal band will also produce irritation; still this may be mitigated by substituting adhesive strips. Nevertheless, see what an amount of stretching has to be done.

Fractures of the femur are mostly oblique, and occur most frequently in the upper fourth of the shaft; next, in the lower fourth.

In the first, the displacement of the upper fragment is due to the combined action of the psoas and iliac muscles, perhaps aided by the pectineal and short head of the abductors, and outwards by the external rotators. The lower fragment is drawn up by the flexors of the thigh and outwards by the tensor, vastus and gluteal muscles, and then you have deformity and angularity. Now, the object is to keep the fragments as nearly as possible in their natural positions, and thereby obtain the least possible shortening. Though most all surgical writers state that there will always be some shortening, and the shortening of the limb of one-half to one inch is generally accepted as a very good result. They also guard us against this and other defects, and recommend the various uses of compresses, splints, bandages, etc. But can the fractured ends be kept in coaptation by the long splint and prevent complete shortening? Can the contractile resistance of the muscles be over-

come by keeping the patient in a dorsal position, with the limbs straight, the shoulders low, while at the same time employing traction? I think not, for it is not the best position to relax such powerful muscles as those of the thigh, and in particular not for those that do the most mischief towards producing the deformity. The tonicity of the muscles cannot be overcome by employing heavy weights and strong pulleys; they are only more irritated by that procedure. Spasms are produced in addition. You may tire them out in time, but the patient will be tired out also. I have never seen any patient comfortable with the long splint. To produce relaxation and coaptation we want a position as near as possible to the natural one, and this position is the double inclined plane.

Now, anybody can try for himself. Let him lay down flat on his back with his legs stretched out for one to three hours, and he will see and feel what a hard work it is to keep in such a position. But he will feel immediately relieved by flexing his legs and raising his body into a semi-inclined position. Try it and you can at once sit thus for hours, without becoming tired. Why? Because your muscles are relaxed and are at ease. By flexing the leg, you relax the biceps, semi-tendinosus, and semi-membranosus. You next have to overcome the rigidity and action of the psoas and iliac muscles. Here you have a double action to overcome. When these mus-

cles act from above, they flex the thigh upon the pelvis naturally, and rotate the femur outward. If they act from below, the femur being fixed, these muscles bend the lumbar portion of the spine and pelvis forwards naturally. I do not see how this double action can be overcome by keeping the body and legs straight. The semi-inclined position of the body and flexion of the leg, seem to me to be the nearest to a natural position, and the most likely to overcome the difficulty under consideration.

I know well that when a bone is fractured the muscles will contract, but I also know that they will relax completely if left alone, when put in an easy position. It may also be said that while the tension of one set of muscles is taken off by this position, it necessarily increases that of another or an opposite set. It is true, but the double inclined position reduces this evil to a minimum. The double inclined position is also preferable in fractures of the femur immediately above the knee-joint, for here the gastrocnemius muscle drags the lower fragment backward into the popliteal space, and this you can only overcome by flexing the leg. All the straight splints and pulleys will do no good. This is admitted even by distinguished surgeons who do not employ this method.

I think that in the treatment of fracture of the femur, the long, straight splints are inconsistent and unnatural, and do not fulfill the purpose at all; that

by the use of them, deformities and shortening must necessarily be produced. I believe that any fractured femur, treated with Physick's or Desault's long splint can be instantly recognized, post mortem, by the way union has taken place, the upper fragment pulled upward and a little outward, the upper end of the lower fragment pushed inward, the newly-formed callus uniting them obliquely, if the fracture has been in the upper fourth of the shaft; and why? because the body and leg have been kept straight—and the femur is not straight, not perpendicular. Take the body standing erect, the heels close together; then draw a perpendicular line from the umbilicus down between the two heels; also a line from the axilla, on both sides, down perpendicularly and across the line below and above, to form an oblong square. Say the transverse line from axilla to axilla measures eighteen inches, the transverse line below the feet also eighteen inches, nine inches on each side from the line drawn down from the umbilicus; take this position as the natural one, the arms pending; then look at the femur. Is it perpendicular, or is it oblique? A line drawn from the greater trochanter to the internal condyle, runs from above downward and inward. The internal condyle is, therefore, longer than the external one, to make up the plane, straighten the lower leg, and bring the knee-joints together near the line of gravity to the body. The femur is not and does not hang perpen-

dicular from its socket. If it did, our legs would be apart instead of together in the erect position. Now if the long splint is applied from the axilla perpendicularly down below the foot, the body will not touch the board anywhere except in the axilla. It will be two or three inches away from the crest of the pelvis, and about six or seven inches from the foot; the foot is pulled toward the board and the limb bandaged, the intervening spaces filled up with cotton; in a great many cases the limb is still dragged more outward; this acting as a lever must necessarily push the upper end of the lower fragment of the femur inward beyond its natural line. If, instead of pulling the foot or heel six or seven inches, or more, towards the board, the foot be left in its natural place, and then this space filled up by some soft material, it might answer a better purpose to keep the femur in its natural position.

To get a good result in any fracture, it is necessary to keep the bone as nearly in its *natural* position as possible, so the femur must be kept in its natural position. But, if you expect to keep the femur straight, in the actual sense of the word, by a straight splint, you will certainly be deceived. It will be crooked. This is what we should avoid, and we can only do it by the double-inclined plane apparatus. The word "*straight*" has misled many and will mislead more.

My method of treating these fractures is simple: To put the patient on a firm mattress; to elevate the

foot of the bed three or four inches; the shoulders also elevated, even as much as the semi-sitting posture; the fractured thigh upon a double-inclined, firm, yet soft, pillow, the foot against a board or pillow; the body and the leg will make all extension and counter extension needed. The pillow must be made to fit and suit the individual case, for the right or left side, as may be required, firm and solid, yet soft. The mattress should also be firm and even. No one should undertake to treat a fractured leg unless he can obtain a good mattress; to expect a good result upon a loose corn husk pillow or feather bed, is simply ridiculous.

Instead of a pillow, a triangular wire frame may be constructed to which may be fastened strong bandages or sack cloth.

I have treated cases, particularly in some old persons, by this simple means with success and ease to the patient. Sometimes, if necessary, I put, in a day or two, an adhesive strip about two and a-half or three inches wide, along the inside of the thigh, below the fracture, forming a loop at the knee and running it up on the outside; the same as is done and used at the foot; apply another piece of plaster or a bandage around the thigh, to keep the first in its place.

I fasten a post at the foot of the bedstead, not opposite the foot of the injured limb. If it is the right leg, I put it a little to the left of the median line from the umbilicus. A roller is fixed into the

post, a cord (an India rubber rope is best) fastened to the loop, which extends to the knee, and running over the pulley in an oblique direction; the cord must pass on the inside of the great toe; a weight hung to this of from five to ten pounds,and increased if needed; or, simply tie the cord to the post. Here the extension, if wanted, is direct from the thigh, and a great deal more force can be employed than from the leg, but, in general, it is not wanted. If the patient is very restless,. I employ splints of wood or reed, one-half to three-quarters of an inch wide, and the proper length, glued to cloth, properly and accurately fitted and buckled, pinned or laced; that is all. One anterior and two side splints of felt, leather or pasteboard would answer. I dispense with the perineal band altogether. The risk of œdema is not greatly to be feared, if this method is employed, as the limb rests upon a soft pillow, and the foot is not bound down, but can be moved and elevated at intervals. The body is prevented from slipping down, first, by the elevation of the foot of the bed; secondly, by the pillow, which offers a firm and gentle resistance, and against which the whole length of the thigh rests equally, and so prevents overlapping of the fragments. The other limbs of the body are not incumbered and can be moved and used with comfort, and without interference with the injured limb. This is, in my experience and opinion, the best mode of treating fracture of the femur. Next to this, I should prefer

Hodgen's or Smith's wire splint, which I often employ, or any other double-inclined apparatus in preference to the long splint. Even for fracture of the neck of the femur, this mode will answer better; but it must be observed, that special apparatuses may be well adapted to special cases. No one apparatus is applicable to every case.

I do not claim anything original in regard to this treatment, nor even perfection. There is nothing new under the sun. Petit, Heister and Duverney long ago recommended the extending means to be applied just above the condyles of the os femoris. (See Cooper's Dict., 1830.) All I claim is, that the double-inclined apparatus is the more natural one, and that I use the extension, if any is needed, from the thigh direct, keeping the femur in as natural a position as possible, that is, towards the *median line* of the body, no matter what splint I employ.

I may here mention that the reason why Profs. John T. Hodgen and N. R. Smith attain such good results with their suspension splints, is simply due to the more natural position they keep the limb in, and the patient does not get tired out so easily.

CHAPTER II.

A REVIEW ON THE TREATMENT OF FRACTURE OF THE FEMUR.

After long study and observation, I gave in the January number of the ST. LOUIS MEDICAL AND SURGICAL JOURNAL, my method of treating fracture of the femur in some cases; and advocated therein the double inclined plane, for reasons for which the reader is referred to the above number of the JOURNAL. A marvelous coincidence brought the January number of the *Medical Record* of New York, into my hands, in which I find on the first page, a lecture on fractures of the shaft of the femur in children, by our distinguished surgeon, Frank H. Hamilton, M. D., with a wood cut illustrating his method, and advocating precisely the reverse of the course that I advocated. My method is intended only for youths and adults. For infants and small children it is not practicable. Dr. Hamilton's article refers to children only, but the fact that his opinion should be so directly adverse to my own, was to me of great interest. I, therefore, eagerly read and studied his article, to find, perhaps, my own mistakes, for it is only by interchanging our views, and by giving each other the benefit of our experience, that we learn. It is this desire that in-

duces me to write this paper, and bring before the profession a survey of the subject.

In my article, mentioned above, I pointed out why the long splints are not well adapted. The reason stated was, that the femur is not a straight bone from its head to the knee-joint, and, therefore, the effort to keep it straight by pulling the leg outward, as is done with most of the long splints, must produce more or less deformity. What is true as to the position of the femur in the adult, holds good in the child. Dr. Hamilton's splint, as Fig. 2 shows, is narrow above, and wider below, so as to pull the legs apart. He applies the same to children under thirteen years of age, and very correctly says: "Fractures in children are often transverse, denticulated, and especially in the very young only partially separated, not at all overlapping or greenstick. The muscles have no power to produce overlapping, and that in view of this fact the treatment should differ." Then he passes, in review, different modes of applying splints, and is particularly disgusted with the double inclined plane, charging it with shortening and with other faults. In this category he includes the lateral and coaptative splints. The doctor tried these machines often in his early days, and never had obtained a good result, except by mere accident. He seems to be exceedingly unfortunate in the treatment of fractured femurs, with the inclined plane and other apparatuses, while other surgeons, it seems, were

very fortunate with these methods, and obtained what was called very good results. We only need to notice Prof. N. R. Smith, of Baltimore, who deserves great credit, and made a wide reputation with his anterior wire suspension splint, which he almost exclusively used in all cases, and Prof. John T. Hodgen, of this city, with his double inclined wire splint, which he employs in an extensive private and hospital practice, who testify as to the good results they obtain, even in children. I admit they may have their faults, but they are so limited in comparison with those which attend the long splints, that they can hardly be taken in consideration. In addition the patients admire them, on account of the comparative comfort they give. I have heard more than one unfortunate exclaim that the inventors of the wire suspension splints ought to be rewarded by a monument. See Guy's hospital reports, London *Brit. Med. Jour.*, June '77, and observe the good results obtained there, with the suspension apparatus. The Smith-Holden splint is truly the only one to be termed the "American."

Prof. Samuel D. Gross mentioned the long splint as having done admirable service in the Confederate army during the war. I saw many of those wounded soldiers brought into our hospitals. They all looked distressed and painful, but felt relieved, and their countenance would brighten up as soon as the old splint was removed and the comfortable double inclined apparatus put on instead. I never heard any

praise for the long splint from any patients. Some bear them with tortitude—that is all. The long splint may do good service when nothing better can be had, but I firmly believe that if no apparatus was used, but the limb simply bandaged together, less harm would result.

Next comes the plaster of Paris and similar splints. They are condemned on account of the danger of strangulating the tissue, causing gangrene from too tight bandaging. It has too frequently been seen that tight bandaging produces gangrene, but then there is no need that it should. Dr. Hamilton again correctly observes that "they are put on straight." A considerable amount of pressure is needed to keep the ends of the bone in their places. In this way undue pressure upon the vessels is made. In addition to these objections, these splints, like all others, become soiled by urine and fæces, which no amount of ingenuity can prevent, yet they cannot be renewed with the same ease as other splints.

I may here remark, in passing, that the plaster of Paris splints need not necessarily be put on immovable, but can be put on in such a manner as to allow an easy opening of them for inspection, as well as any similar contrivance, and can be protected by varnish, yet this does not overcome all of the objections to their becoming soiled. A surgeon skilled in the application of plaster of Paris, can certainly obtain good results. Prof. E. H. Gregory, of this city, who

is an admirer of this method, and I believe almost exclusively uses it in his hospital and large private practice, tells me that he employs it on children; that he has no cause to regret adopting this method, as it serves him well, and has, in his mind, many advantages over other splints.

Dr. Hamilton then proceeds and says: "The straight position with short or coaptative splints, and the single long splint, with pulleys and weights, or such an apparatus as we have found best for adults, fail again in the case of infants and children." We will grant this.

He then describes his method, as shown in Fig. 2. This method speaks for itself, and hardly needs explanation. Instead of one long splint there are two; they are widely separated below, which it is claimed will prevent, in some measure, the soiling of the clothes by urine and fæces. There are short coaptative, splints, pads, bandages, etc.; perineal bands in most cases are used, and for six-year-old children there are, in addition, pulleys and weights. Here we have a most complicated arrangement—the old fashion long splint, with short coaptative splints combined. The gentleman takes great pains in describing all the details of this dressing; while it is true that upon details will depend the success of the result, particularly so of an apparatus that is to be employed by others than the inventor, as the latter cannot be sreponsible for his invention, if it is not used cor-

rectly, yet these numerous details detract much from its usefulness.

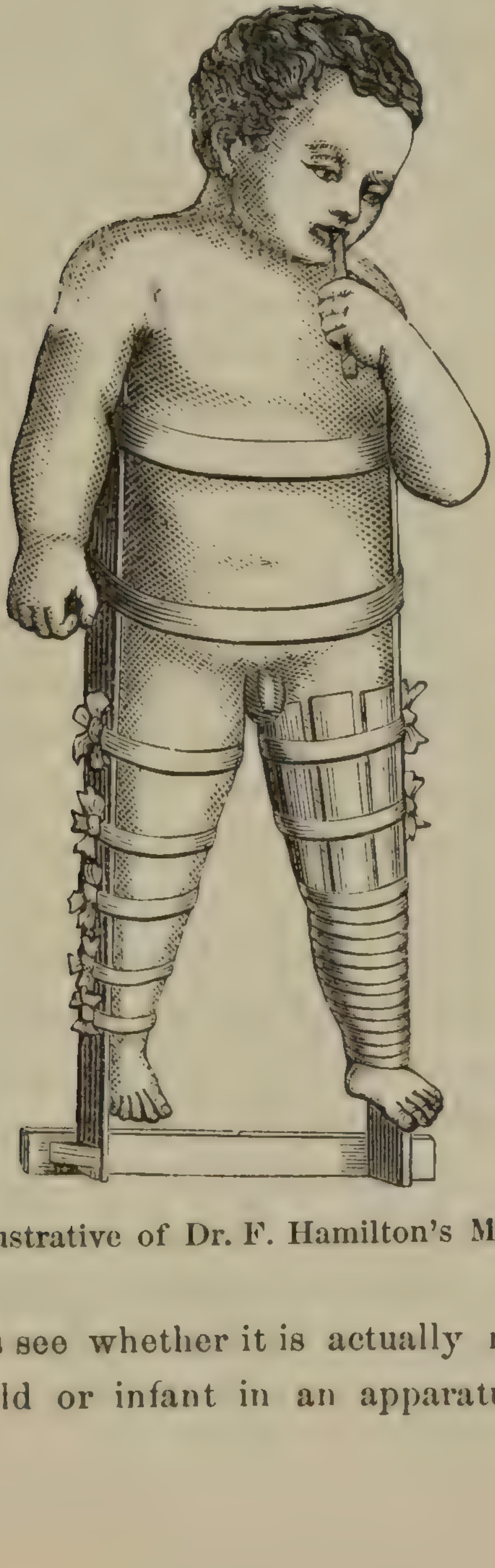


Fig. 2.—Illustrative of Dr. F. Hamilton's Method.—*N. Y. Med. Record.*

But let us see whether it is actually necessary to encase a child or infant in an apparatus like that

which Dr. Hamilton recommends. I have never found such a confining method necessary, and feel sure this is the case with most surgeons for these reasons; First, in greenstick fractures, which almost always occur on the inside of the femur, the outer half of the bone acts as a splint; a single coaptative splint and bandage is all that is needed; in such a case a little moving about by the patient can do no harm, while if the long splint be used, the legs drawn outward and kept straight, we may do mischief; and this may be serious, which would be avoided if we allow a little more natural movement of the limbs. As we do not generally meet with oblique fracture in children, and generally have no contraction of muscle to overcome, we need no extension by pulleys and weights. If this is so, they are superfluous.

In denticulated fractures, it needs a little more care, but by no means does it need such squeezing and splinting as presented by Dr. Hamilton; at least this is my experience. With all due regard for the distinguished learning of the New York gentleman, for I do consider him as one of our highest surgeons, I, for one would not be willing to try this splint in most any case, unless I learned from actual observation the good results that are claimed by the author.

The requirements of splints for any fracture are, that while they fulfill their purpose in maintaining the ends of the fractured bone in proper relation to each other, they should also keep the limb in as natural a

position as possible. It should be light, easily put on and removed; all complicated apparatus renders the treatment complicated, and as it is admitted by all surgical writers that we, as a rule, have no shortening in very young children, it matters not whether we employ plaster, leather, starch or the suspension splints. This much is sure; tie a child up, harness it all over, and the more you put on, the harder the child will struggle to get it off, because of the uncomfortableness of the thing. Besides this, such is the nature of a child, that the less you bundle it up and the freer it has the use of its limbs, the sooner it will feel reconciled to the necessity of keeping comparatively quiet.

We seldom meet with a fractured femur in an infant. It happens mostly after the child begins to walk, but if we should meet them, they may be treated almost without any apparatus; simply tying the legs together is about all that is required. With children under the age of five or six, I prefer the pasteboard splint, as follows: Take a piece of muslin or paper, fasten it around the limb, for the purpose of cutting a pattern; put it upon a good piece of pasteboard and you have it the shape as shown in Fig. 3; reverse it, take a ruler, and cut with a sharp knife three-fourths of its thickness the lines indicated in Fig. 3, or cut parallel vertical lines. It is for left leg; "*a*-*a*" meets at the inside. It may also be formed to meet and open on the outside. Roll it up, and give it good

coatings of shellac varnish; wrap up the limb in cotton batting, apply the splint, tie it with two or three ribbons or bandages, or punch holes and lace it; then tie the limbs together at the knees and the ankles, or bandage the limbs all the way up; put a soft pillow under the knees; then leave the child alone; it can be inspected every day with ease and comfort to the patient.

[Fig 3.—Pasteboard Splint.]

I had as good a result with this as with any other method. It is advisable to prepare two splints at once, so as to have one ready for change, as we well know that it is impossible to keep the bandages entirely clean, even if the child should make its wants known; yet the nurse will have less trouble with this, than with any other method. The nurse can lift the limbs up with one hand, as is generally done, and sponge the parts. With children above the age of six years, when they begin to be more rational, the wire

suspension splint can be used; the patient can move about; also keep clean. I have found it so, at least. I treated, not long ago, a little idiotic child, five years old, for fracture of the femur, with the wire suspension double-inclined splint, and nothwithstanding it was naturally very restless, the apparatus was really used as a toy by the child. When the child was ready to walk, I put on a splint, Fig. 3, which was worn for some time.

Let us now examine the views and opinions of some of the different authors.

Hippocrates commences his work on fractures by giving a general opinion in all cases of fracture and dislocation, the rectification of them by extension, in as straight a manner as possible; the word "straight" signifying here the most natural direction that the limb can take so that the bones can unite properly. He says: "There is no necessity for much study to set a broken bone. Any ordinary physician can perform it; but I know physicians who have the reputation of being skilled in giving proper position to the bone in binding it up, while, in reality, they are only showing their own ignorance." He then used extension and counter-extension, and gives an account of the gutters then used, but does not much approve of them. The leg must be properly extended and put in a straight line, for it is a great disgrace and injury to exhibit a shortened thigh, and recommends that we depend upon the bandages only; and in case

of swelling (blackening) leaving the splint off entirely. He disapproves of the bent position, like all others of his time.

Rhaces is the only one who approves of this partially bent position, and points out the extreme importance of attending to the position of the heel.

Celsus pronounces it impossible to heal a fractured thigh bone without deformity; the patient, he says, must ever afterwards tread upon his toes.

Albucasis: He used long splints; recommended the limb to be bandaged, and the hollow places to be padded with soft material.

Paulus Ægineta: Patient to lie upon his back, the leg to be wrapped in a thick garment, and wool on each side to prevent moving the limb; a foot-board well curved to the foot, the whole covered with a skin.

Prof. Frank H. Hamilton, in both his works on general surgery and treatise on fractures: Thigh bound to long side splints; but admits that later experience has taught him that it is not always well to do so, and has therefore been obliged to devise what he calls his "model splint." (See description, *N. Y. Med. Rec.*, Nov., 1877, *Jour. Mat. Med.*, Nov., 1877.) But Dr. Louis Bauer says (*Md. Med. Jour.* of Baltimore, June, 1878), "It is inefficient and defective in its results, and that Prof. Hamilton informs us, with estimable candor, that shortening of the femur

is the rule." For children two long splints (Fig. 2).

Anterior Wire Suspension Splint of Prof. N. R. Smith.

Fig. 4.

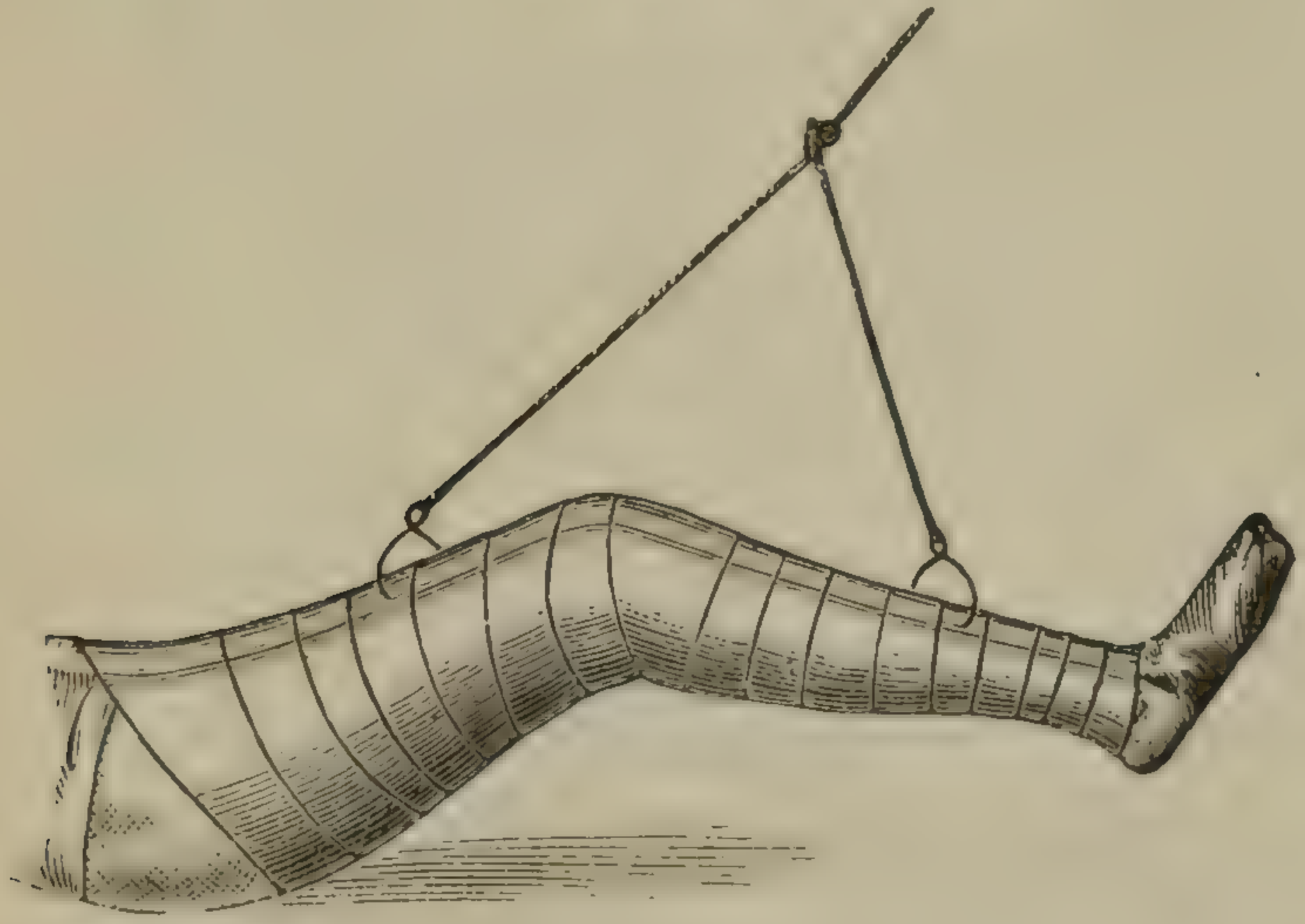


Fig. 5.

Prof. N. R. Smith: Anterior wire suspension splint (Figs. 4 and 5), semi-flexed position. To him undoubtedly belongs the credit of first pointing out the advantages that his invention possesses, and demonstrated it practically.

I may here draw attention, that one single iron wire will answer the purpose as well as the double if anteriorly applied, especially in fractures of the leg.

Improved Wire Suspension Splint of Prof. Jno. T. Hodgen, of St. Louis.

Fig. 6.

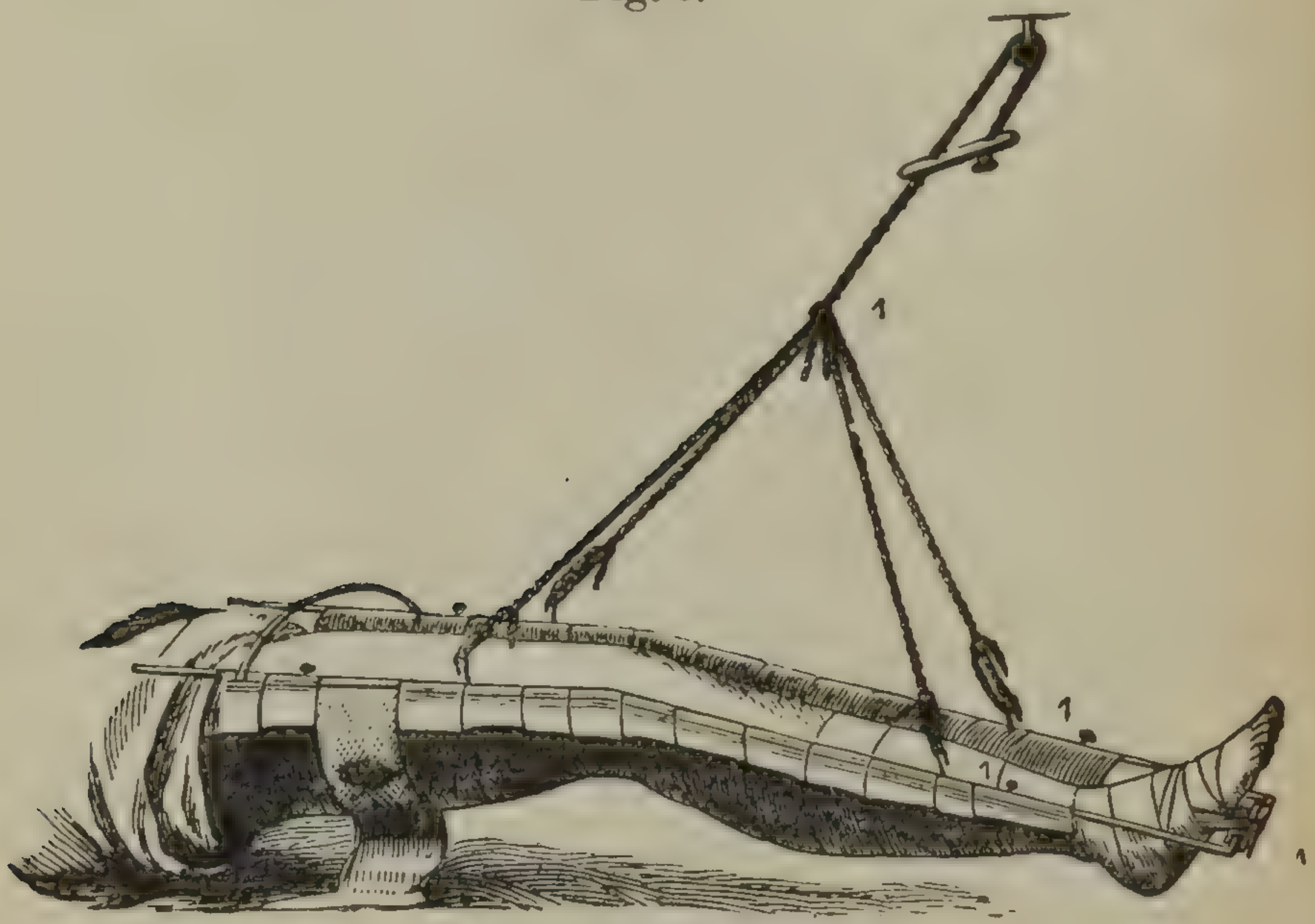
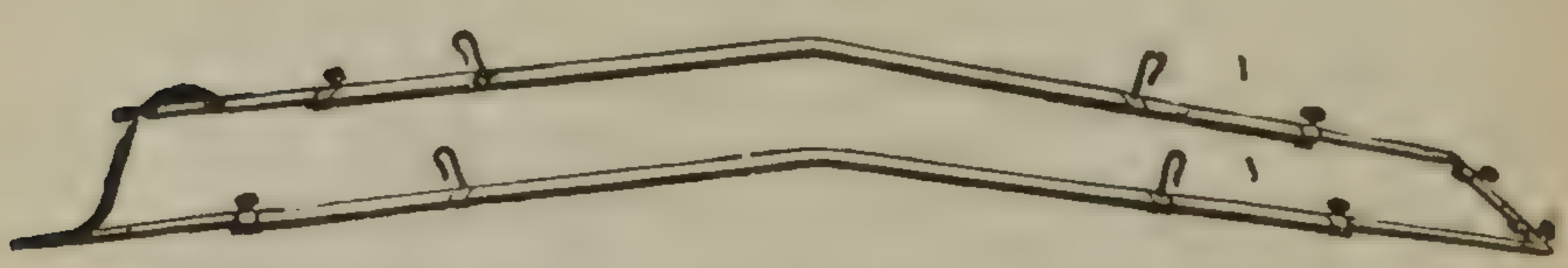


Fig. 7.



This splint (Figs. 6 and 7) is too well-known to need any description. The reader is referred to the minutes on Surgery, American Med. Association, 1877, or *St. Louis Medical and Surgical Journal*, April, 1878, to an instructive paper by that gentleman. "The Value of Extension in the Treatment of Fractures of the Femur," and wherein the faults of the long splints and plaster Paris dressing are well criticised, and the following propositions are made:

Prop. 1. Continuous and equable extension is indispensable to the best results in the treatment of fracture of the femur.

Prop. 2. Continuous and equable extension cannot be secured by lateral supports; the long splint of Liston or its modifications; nor by plaster of Paris dressings.

Prop. 3. Continuous and equable extension can only be secured by suspending the limb.

Prop. 4. Suspension furnishes the best means for allowing motion to other parts of the body, while maintaining constantly perfect apposition of the fragments of the fractured thigh.

DR. LOUIS BAUER'S METHOD.

He claims for his splint (Fig. 8) the following advantages:

1. It admits of the easiest possible reduction of the fracture without assistance. In bending the extremity into the splint, the reduction and coaptation of the broken femurs take place without any further surgical effort.

2. It immobilizes the knee, the fracture, and partially the hip-joint, a desideratum pointedly and properly insisted on in the seventeenth aphorism of Prof. Cowling.

3. It secures the ease and comfort of the patient during a lengthy confinement by a soft and convenient cotton bed for the limb.

4. It prevents retraction of the lower fragment

through the angular position of the extremity and likewise obviates the slipping of the pelvis so as to give rise to overlapping from above.

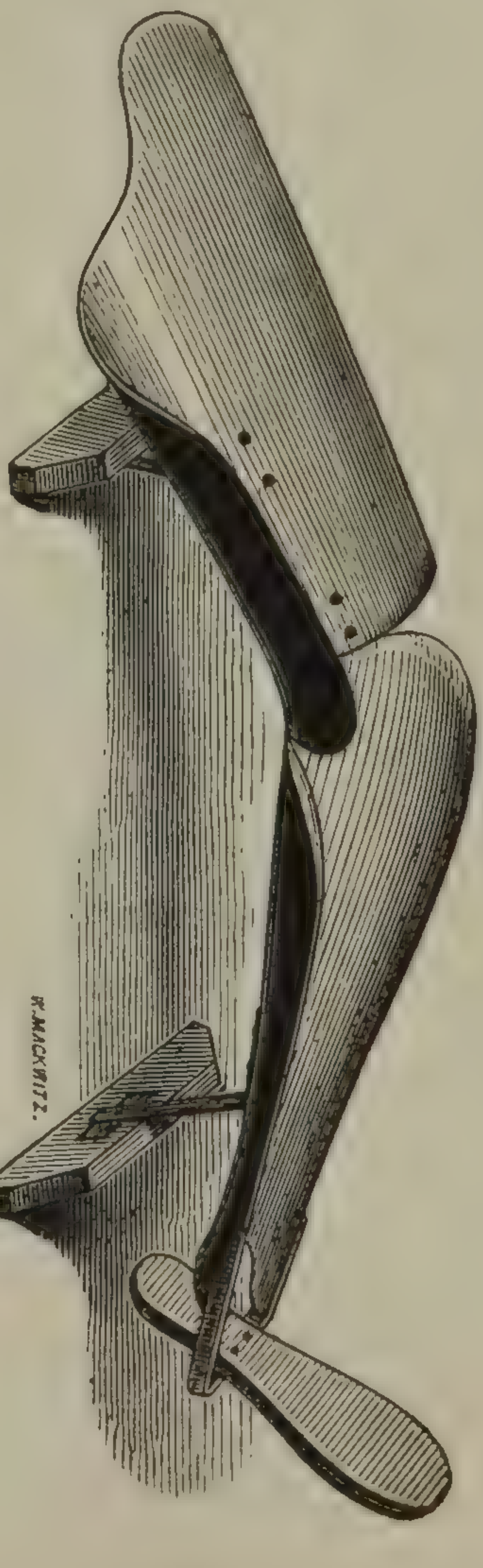


Fig. 8.

Double-inclined thigh splint of Dr. Louis Bauer, of St. Louis.

5. It renders the fracture easy of access without any disturbance of the patient.

All these advantages will, of course, only be secured, when the splint is accurately measured for and adapted to the extremity, when the latter is well padded with cotton, when a leather splint is placed upon the front of the thigh and the extremity securely held to the splint by flannel bandages from the foot to the hip. The apparatus is made of thin sheet iron, and may also be suspended if desired.

In regard to the wire suspension splint, the doctor thinks that in fracture of the upper half of the femur it affords too much range of motion, prejudicial to the union of the bone, which may cause pseudarthrosis; extension seems to him needless.—*Clinical Record*, St. Louis, March, 1878.

Prof. A. P. Lankford, of St. Louis, writes:

DEAR DOCTOR:—Your polite invitation to describe my method of treatment of fracture of the shaft of the femur for a monograph which you are preparing upon the subject, is received. While I have nothing new in principle to offer, I yet comply with pleasure, believing that the diversity of opinion amongst teachers and authors of recognized text-books upon so important a subject is alone sufficient reason for your contemplated work. And permit me to add that, in my opinion, your plan is an excellent one; making it, as it will, a true exponent of the

opinion and practice of St. Louis practitioners. It will surely entitle you to the thanks of the profession.

The difficulties encountered by the practitioner in the *reduction* and subsequent *support* of the fragments arises from muscular traction and irregular contractions; necessary movements of the body and extremities; the situation of the bone (surrounded by heavy masses of muscles and located between two articular surfaces;) the ready mobility of the cutaneous envelops; the injury produced by displacement; the function of the part (a supporting extremity) and the peculiar shape and uncertain condition of the broken limb.

It is easy to say in the language of a most eminent modern surgical teacher, that the indications "to be fulfilled are co-aptation and fixation of the fragments; and second, moderate extension." Speaking literally the first is rarely practicable. We can only approximate. By careful rotation and continuous extension the broken ends may be accurately brought together or approximately so, restoring, or nearly so, the normal axis and length of the bone. To maintain the fragments in this position with the least possible disturbance, and the greatest consistent comfort and freedom of the patient, is the problem to be solved. It is to be mainly accomplished by the aid of permanent extension and position. The extending force should be applied to the distal section of the extremity—the leg—and as a rule with adhesive strips sep-

arated at the foot by a light block to prevent pressure upon the malleoli. This is one of the most, if not the most valuable discovery for the treatment of fractures in the history of our art. The position for the fractured extremity should be one of suspension—the elevation being sufficient to permit the limb to swing clear. This is best accomplished with slight flexion, but this does not prevent the support derived from pressure of the joint surfaces at both ends.

The requisite degree of extending force can always be obtained by increasing the angle of inclination of the suspending cord. No splint or bandage should be applied at the point of fracture, the limb being left exposed to the ready examination of the surgeon and unincumbered by the pressure of painful and often mischievous so-called supports. These conditions are fulfilled by the Hodgen wire suspension apparatus introduced to the notice of the profession as about to be described, by Dr. Jno. T. Hodgen of this city. This excellent contrivance has been so often described by this gentleman and others that it is unnecessary to repeat it here. Its construction is simple, and when understood the application is easy. In a few cases I have had some difficulty in preventing eversion of the foot and consequent rotation of the bone. Another annoyance is found in the slipping and rolling of the strips of muslin upon which the limb rests. These are secured around the rods by pins. To obviate these minor objections I have sub-

stituted for the iron rods two pieces of board, one and one-half inches wide, and three-quarters of an inch thick, except at the lower ends, which are four inches wide for about five inches, and then gradually cut down to the uniform width. These are united by a block, about four inches square—the width adapted to the size of the limb. A single hole near the lower border of this cross-piece serves for the passage of the cord attached to the adhesive strips. A knot on the cord fixes it securely. Buttons are screwed into the side-pieces (on the outside) three or four inches apart (or common screws may be used) the entire length. The strips of muslin are buttoned over these. Should it be desired to tighten up the strips at any point, the surgeon cuts the "button-hole" in an instant with a knife or scissors, thus making the cradle in which the limb rests fit accurately and uniformly from ankle to trochanter. There is no subsequent slipping or displacement of any kind, while the ankle and foot sinking down between the widened ends at the sides are kept steadily in the position the surgeon desires—no eversion being possible. A thick fold of lint or cotton may be interposed between the side of the foot and the board to protect it from pressure.

The limb being properly placed in the cradle, made fast at the foot, and a few strips buttoned on for temporary support, the suspension is made precisely as with the wire apparatus. When the whole swings clear the surgeon buttons up the entire course of

strips, giving uniform support throughout. If it is desired to flex the thigh upon the body and the leg upon the thigh, the pieces beneath the knee are drawn up short, elevating the knee, while those beneath the ankle are let out, thus dropping the foot and leg as low as the extending cords attached to the adhesive strips will permit. The intermediate strips are then readjusted so as to give uniform support.

This dressing may be relied upon in fracture of any portion of the shaft—upper, middle, or lower third—to as nearly as possible overcome all the obstacles enumerated above as commonly encountered in the "coäptation" and "fixation" of the fragments of any fracture. Exact restoration and maintenance in the normal position of the broken bone is rarely ever possible. This would be a perfect result. We can, however, I think, approach nearer the ideal (sometimes attain to it) by keeping the extremity suspended in this apparatus, its axis always the base of an obtuse angle, than by any other device known to the profession.

By the slight flexion, and by fixing the extending strips upon the sides of the leg, instead of the thigh, an extending force is secured which it is impossible to safely command by any form of straight, long and short splints and bandange or when the extending plaster is applied to the loose, sliding elastic skin, so near to the point of fracture as above the knee. It is applied with least possible disturbance of the frac-

tured bone, and is worn with the most comfortable feelings of the patient. It permits all necessary movements of the body from the pelvis up, without moving the fragments upon one another. The requisite extending force to oppose muscular traction and irregular spasmodic action (the latter often aggravated by the pressure of splints forcing the soft parts upon the sharp serrations of broken ends) of muscles, is obtained by increasing the inclination of the suspending cord. The extended muscles surrounding the bone gives uniform but gentle support from every direction. It leaves the thigh exposed so that a glance of the surgeon is sufficient to detect any marked deviation of the axis, or displacement. Thus it will be seen that the obstacles to a successful management of any fracture of the femur are met by this apparatus. The same injury in infants or young children can be better managed perhaps by dressing with the movable sole leather "collar" or "gutta percha," cut out of proper length and width, and then, after immersion in hot water, moulded to fit the injured extremity. A single piece of sole leather, if this is preferred, after being cut down to proper dimensions, is made pliable by immersion in water and then given the proper shape. It is then well padded and buckles and straps attached. When the fracture has been reduced the limb is firmly held in an extended position until the leather "collar" is securely buckled on, the foot and leg

being previously bandaged. The "collar" may be removed when desired for examination or cleansing the thigh and buttocks, which are so frequently soiled. If the gutta percha be used, it can be kept in place by adhesive strips and bandage, and may be removed when necessary, as when the collar is used. I generally prefer a single piece, long enough to reach from the trochanters and just above the glutco-femoral crease to the knee.

I have used the so-called "immovable dressing" (plaster of paris) in two cases, but, although a very good result was obtained, was not pleased with it. It gives both surgeon and nurse much more trouble than either of the dressings just mentioned.

In an experience of seven years, in both private and hospital practice with the above named apparatus, I have never had a result of which the patient complained.

Samuel D. Gross: Fracture-box with splints—straight position.

Physick and Hodge: Long splint.

Sir A. Cooper: Patient lying on his back, limb in bent position for fracture of neck of femur; sees no reason for not giving it a fair trial in other fractures of that bone; in fracture of condyles, straight position.

Liston: Long splint.

Sir Charles Bell: Double inclined plane.

McIntyre and Sanson: The semi-flexed position.

John Erichsen: An exclusive plan of treatment should not be adopted for all cases; gives four different ways to conduct treatment, viz: flexing, extension, double incline and starch bandages.

John Ashhurst, Jr., has never seen a perfect cure; consideres one-half to one inch a satisfactory result; thinks the weight and extension apparatus the most convenient.

Pott: Limb on its side, knee bent.

Billroth: Plaster of Paris splint; says the more practice one has in applying them, the more rarely will bad results happen.

Fergusson: Straight splint.

Gosselin, "Surg. Diseases of Youth:" Points out that patients cannot lie squarely on their backs; the attempt to do so produces pain; that shortening always exists in adults. Employs Scultet apparatus, and semi-flexion, also uses Honnequin's splint. Uses extension, and prefers the movable bandages; says that none of the continuous extension apparatuses have taken rank in practice.

Holmes: Children's fractures heal without any perceptible shortening or deformity; the treatment simply consists in rest, on a splint with knee and hip bent.

Guersant: Simple fractures in children heal without difficulty or deformity; if there is deformity, time modifies it; for men have presented themselves

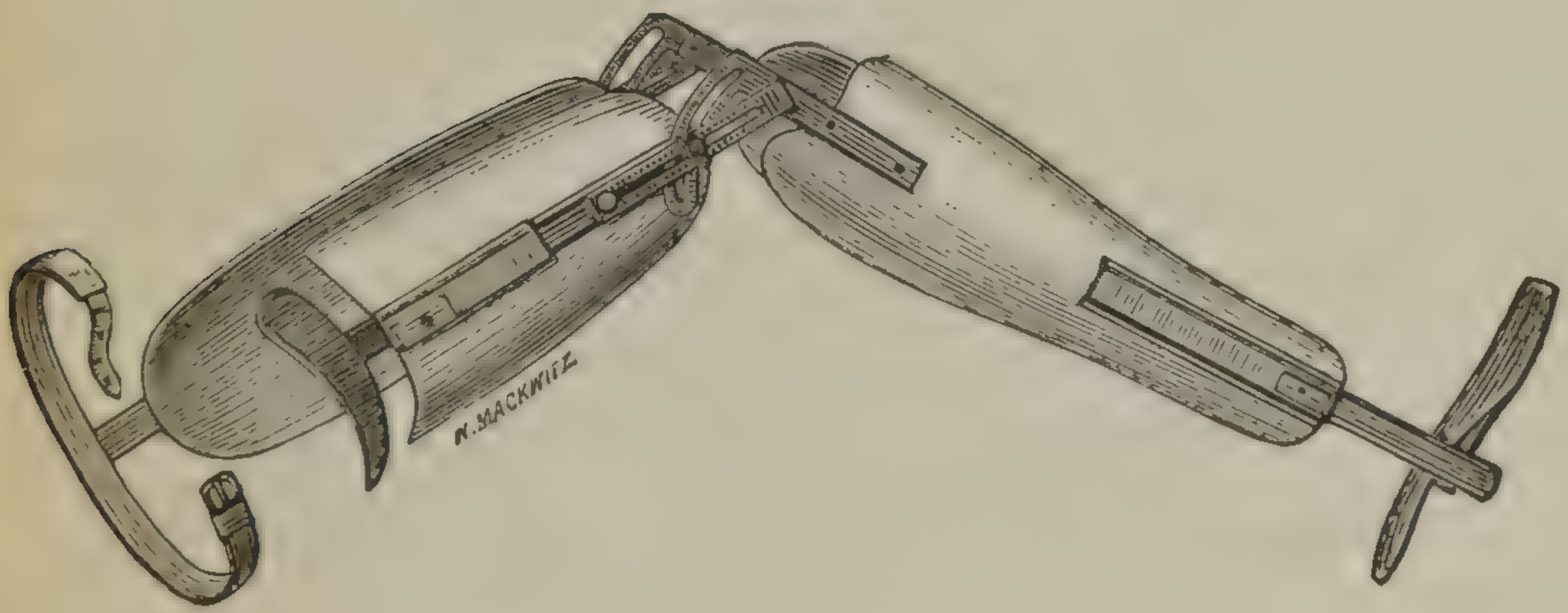
with a proven record that their femur had been broken when a child, and yet, when examined it could not have been decided, in many cases, that any fracture had existed. Nearly all of those individuals were fit for military duty. He employs Dupuytren's method.

Prof. C. Heine, Insbruck: Plaster of Paris.

The reader is also referred to Dr. Cowling's paper on fractures, read before the Central Kentucky Medical Association, July, 1877, which contains valuable points. (See *Louisville Med. News*, Dec. 29th, 1877.

Splint of Dr. Jno. W. Trader, Sedalia, Mo.

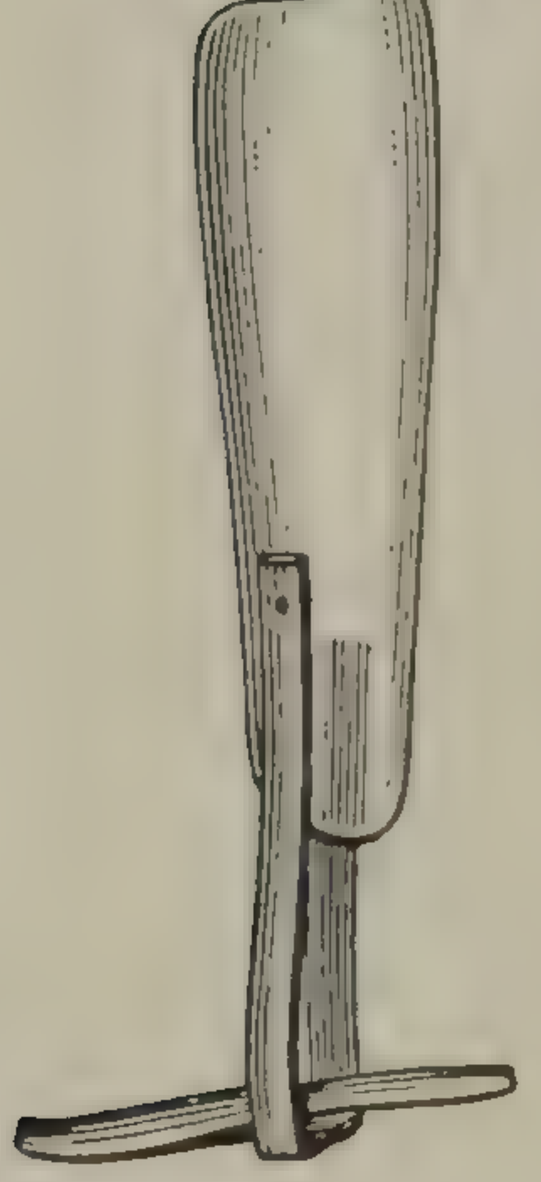
Fig. 9.



The object of this splint is to give the proper extension to fractures of the thigh, without distressing and constantly pulling upon the muscles. The plan is simple, and the splint is easily applied. Two powers are represented: the lever and inclined plane.

To apply the splint, first line it with cotton batting and see that it fits snugly without pinching; then make secure below and above the knee by sufficient turns of the roller bandage. A little starch is used to set the bandage firmly and to prevent slipping. It is so arranged that when the limb is made fast in the prone position, and the starch allowed to dry, a

Fig. 10.



Inside.

Fig. 11.

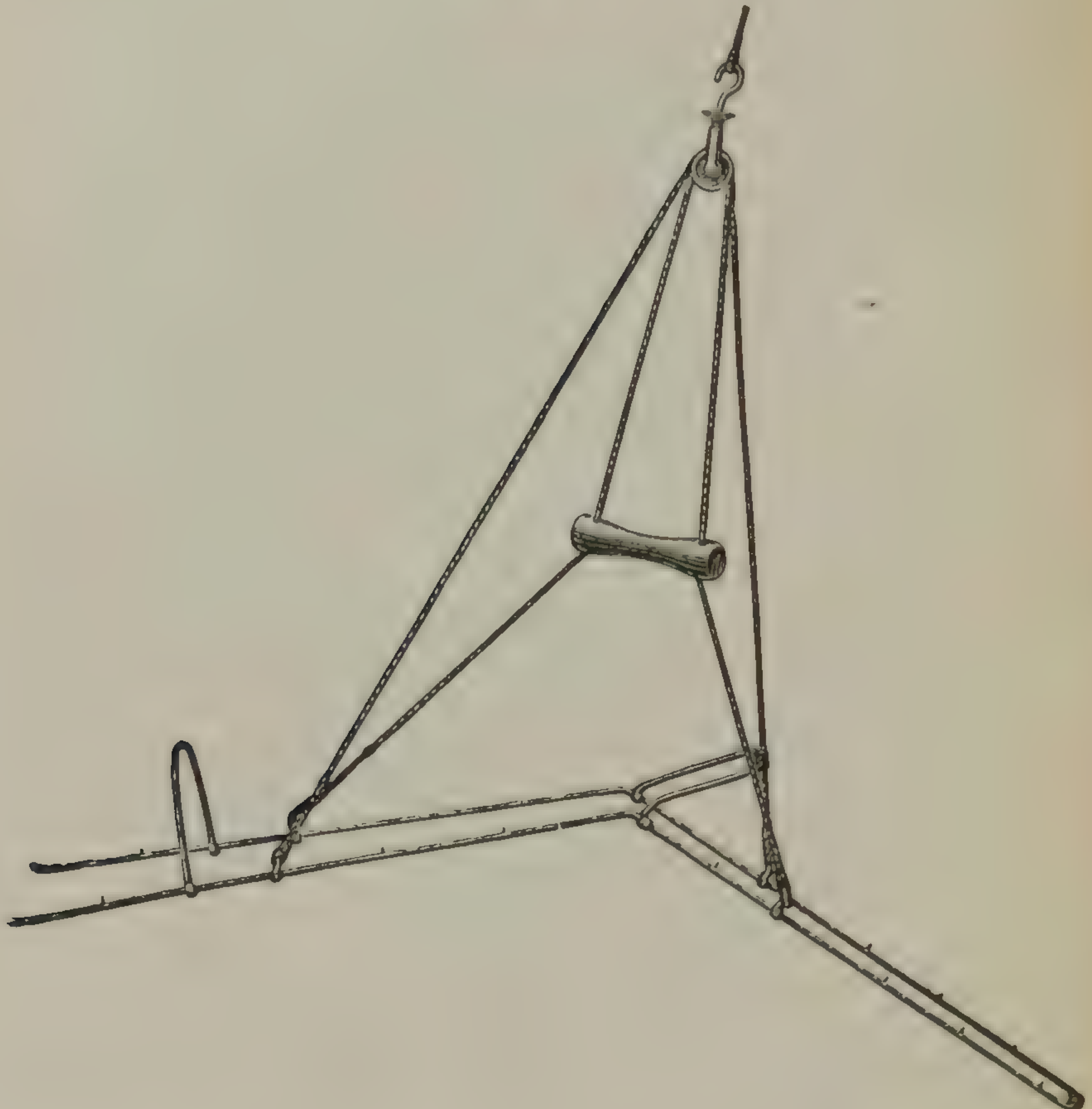
Outside.

slight flexion will bring about the desired extension. The joint is then made immovable by set-screws. The hinge at the knee-joint is arranged eccentrically, and gives an extension of about two inches in a straight line, when the leg is flexed at an angle of 45° at the

knee. This extension is constant and painless, there being no necessity for adhesive plaster complications, or any undue pressure upon any part. A well-fitting horn-like crutch-head rests in the groin and by the side of the perineum, pressing toward, but not against, the pelvis. The outer splint is extended by a jointed arm passing up over the illium, and fastened around the body by a broad belt or bandage. The foot and head pieces are made to slide in and out of their cases, so as to be easily adjusted to the length of the limb, and to provide for any slack that may occur. These ends are also secured by thumb screws. In intra-capsular fracture of the thigh, the splint has acted admirably, allowing the patient to move about after the initial soreness had subsided. There did not seem to be any movement of fracture incompatible with the healing process, and the extension was easily kept up; the shortening only being three-quarters of an inch one year from date of injury.

Splint of Dr. G. Wiley Broome, of Moberly, Mo.

Fig. 12.



This represents a modification of the anterior suspensory apparatus for the treatment of fractures of the femur and extensive injuries of the lower extremities.

This splint has been so modified by the Doctor for the following reasons, viz:

1st. It gives the limb the most natural position

while at the same time it maintains the ends of the broken bone nearest to its natural relations.

2d. It immobilizes the hip-joint and consequently quiets the great coxo-femoral muscles—an essential measure to prevent shortening.

3d. It gives steadiness and gentle traction to the broken thigh by adhesive straps around the knee and fastened to the wire bow for that purpose.

4th. It dispenses with the linear method and its consequent discomfort and excoriations.

5th. It also enables the patient to get up well at the end of five to eight weeks without the painful hindrance of a stiff knee and sore heel.

6th. It dispenses with the perineal band and besides its practical application, will at once condemn the idea of eternally pulling on the leg to get it straight.

7th. It teaches that to place the patient comfortably and his injured limb in its natural physiological position, that pulling is unnecessary, and indeed decidedly hurtful.

8th. It abducts and places the knee semi-flexed, thereby bringing the lower fragment in its proper relation with the upper.

9th. It prevents inversion or eversion of the foot.

10th. There are permanent pins arranged in the wire which facilitate the convenience greatly and enable the surgeon to apply it in a few minutes.

11th. It allows the greatest convenience in mak. ing application to the fracture if compound.

12th. The upper fragment is immobilized by the application of the silicate of soda bandage, extending around the pelvis and over the upper ends of the wire.

13th. The whole appliance consists only of a piece of wire bent as is represented in the cut; five yards of cord and two pulleys and an old sheet. The sheet is torn in short strips for suspending the limb by attaching them to the stationary pins upon the wire frame and extending from one bar to the other beneath the leg and thigh when the limb is suspended, after which a long roller bandage is saturated in a solution of silicate of soda, and then applied around the hips for the purpose of constraining its mobility.

Splint of Dr. C. R. Parke, of Bloomington, Ill.

Fig. 13.

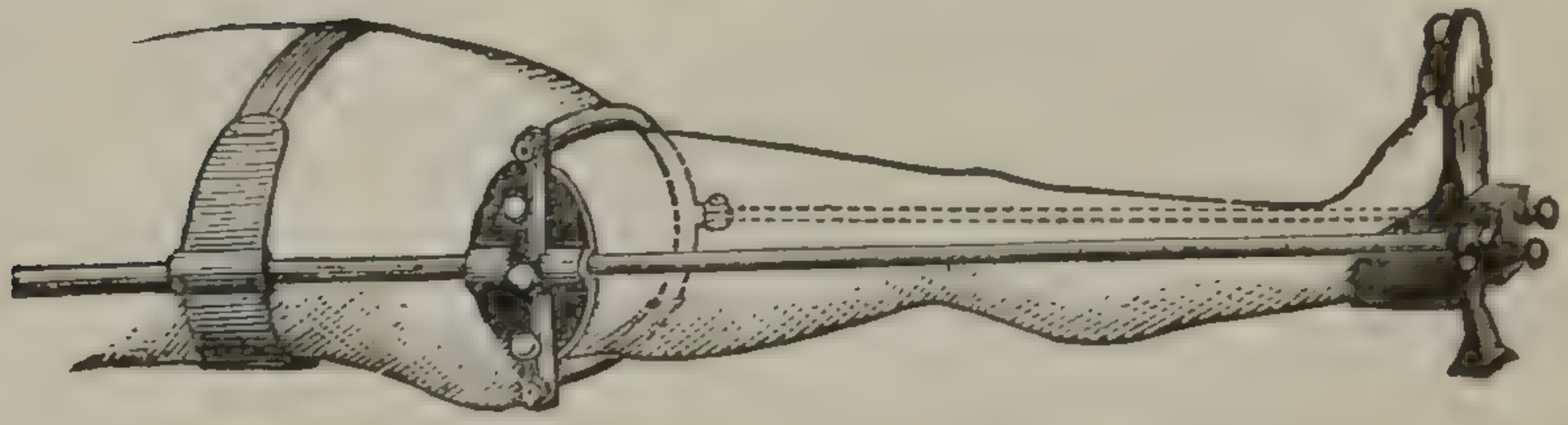
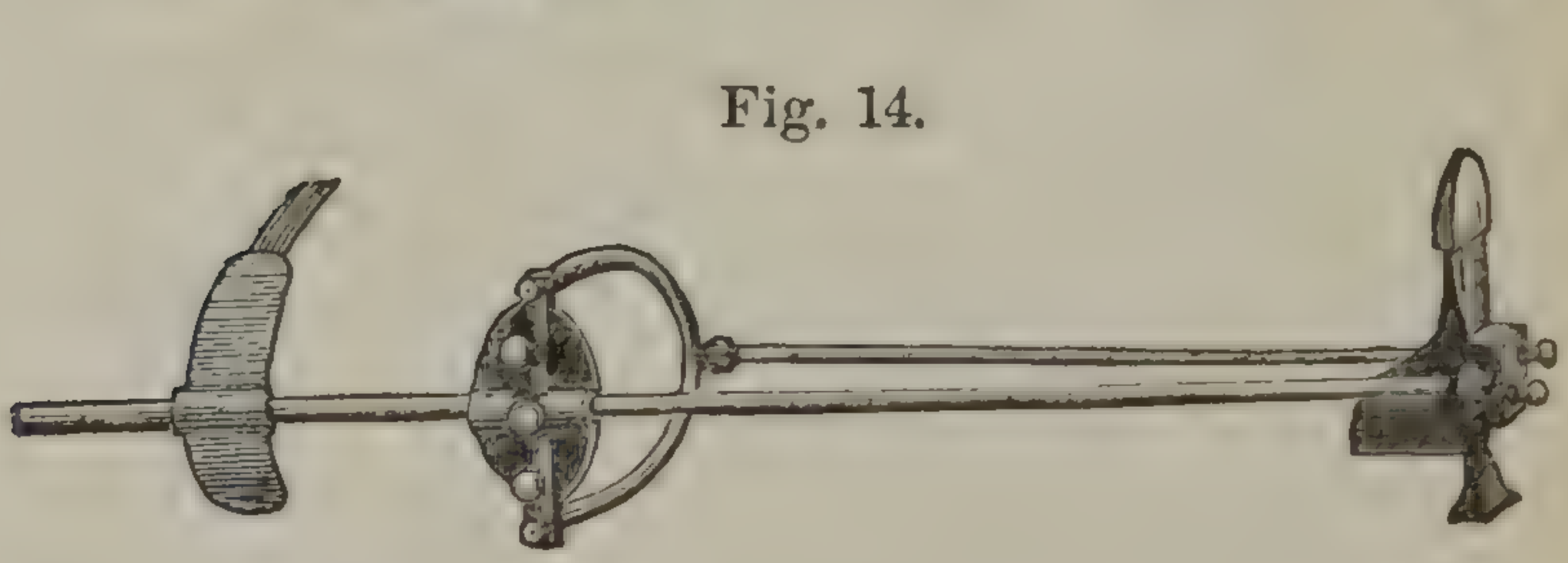


Fig. 14.



Dr. C. R. Parke: Metallic fracture splints; long ex-

tension and counter-extension by tubes and rods; claims *no shortening*; the fracture can be examined without interfering with this apparatus. It is a neat contrivance, and appears to be preferable to any of the old-style long splints.

In the first place, the application is simple, the limb being placed on the prepared dressing and the splint built up around it.

Secondly—The amount of extension is fixed.

Thirdly—The dressing can be thrown off and limb examined without disturbing extension.

Fourthly—The patient can be turned on side preparatory to defecation or cleanliness.

Fifthly—He can be propped up in bed at an angle of 45° or less if necessary without interfering in the least with the fracture, or if it is a compound comminuted fracture the limb can be extended in the trough without bandaging, and suitable applications made. No pressure on femoral vessels. In warm weather the air is permitted to circulate under the limb, while in case of a compound fracture with wound on posterior portion of the limb, the patient can be rolled over on his side, and, by means of a trap-door, injections, dressings, etc., can be applied to wound without removing bandage or interfering with extension.

MANNER OF APPLICATION.

The mattress being properly prepared, the long extension tube is placed in position with suspension slips folded in their center over it. Upon these are

placed the strips of "Scultitus," and over them a pasteboard or other splint covered with soft muslin. The slipper and foot plate being secured to the foot by strips of adhesive plaster, in the usual way, the limb is placed above the dressing, with seat of fracture over center of pasteboard. The bow having been wrapped with cotton and covered with cotton flannel, roller securely stitched, is now placed in position round upper thigh. The limb is extended, bones coaptated, and the "Scultitus" bandage applied firmly from ankle to perineum. A pad is slipped over the ends of the bow, followed by side-plate and secured by nuts. The lower end of long extension rod is raised and fastened to slide in foot-plate. The lower end of short internal rod is raised to its proper place and secured in like manner. The ends of the upper layer of suspension strips are brought up on inside of internal rod, and ends of lower layer on the outside, when they are pinned together, thus suspending the limb in a comforatable manner. The Scultitus strips are now thrown back exposing the limb and seat of fracture, *proper extension made and secured*, fracture carefully adjusted, short splint placed on sides, when the Scultitus strips are snugly re applied. Tapes from the lateral rods tied over the top complete the dressing. By turning the splint over and reversing the foot-plate, it is ready for the opposite limb. (See a paper read before the McLean County Pathological Association, July 1, 1878.)

It is not necessary to repeat all that has been written upon this subject, nor give every author's name; to him who desires, is afforded a large treasury in the text books and Medical Journals; suffice to say: That the contest is between the long straight splint and the flexed position. To understand their merits and defects we must study each attentively and judge for ourselves, and to our best conviction, apply it in practice, and while we have due regard for the opinion of others, still defend our own opinion. In my mind, there is no doubt and my experience in practice has convinced me, that the bent or flexed position in the treatment of fracture of the femur, no matter by what means maintained, is decidedly the superior and an irrefrangible fact.

I am an ardent admirer of the suspension splint, having been early trained to the use of it by my teacher, Prof. N. R. Smith, but beg leave to call the attention to one point, that is the allowance of motion to *other* parts of the body, and maintaining constantly perfect apposition of the fragments of the fractured bone. This can only be done in one way, as long as the patient moves around in a certain direction, that is in a given circle, to the right or left, keeping his body within a certain periphery, then the fragments will not be disturbed; if he moves his body in a horizontal direction toward the head of the bed, traction increases, if he moves down toward the foot of the bed, traction will diminish, the more he does so; if the sus-

pending rope hangs down perpendicularly (vertical) there is only rest; equable and continuous extension ceases; if he still keeps on slipping down the action will be reversed; it is therefore well not to overrate the free movements of *other* parts of the body, when the suspension splint is employed, and allow our patient to move his whole body where he pleases, but instruct him well how to change his position, keeping in view that continuous and equable extension is indispesnable; if no good result is obtained with this splint, it certainly is not the fault of the splint; for the latter we have to look in another direction. I prefer to place my patient, when using this apparatus, in the middle upon a large mattrass, so as to give him ample room to change his position. I lately treated a bad comminuted fracture of the femur with the suspension apparatus in addition with the coaptation pasteboard splint, with benefit, and always use a foot board. The wrinkling and slipping of the bandage may be obviated by applying salicate of soda or starch.

Dr. Henry Austin Martin, in a paper read before the Amer. Med. Association, 1878, "Surgical Uses of the Strong Elastic Bandange," states that by the use of the same, and the gentle constant pressure attained by them over a splint, he gradually accomplishes the reduction of greenstick fracture without deformity; he also uses them to straighten out bad unions of recent fractures with success. It may be that the elastic bandage would be productive of

much good in fracture of the femur to prevent angularity.

In conclusion, I will remark, that if I was to employ a long splint, it seems to me, that one applied to the inner side of the leg, well padded, with foot piece for both feet, like the letter T, and crutch-like above, kept in the median line of the body, both leg bandages to the same, would be preferable to the outside splint, though I never tried it.

In regard to the measurement of the limb, to ascertain the amount of shortening, the general method employed, is from the anterior superior spinous process of the ilium to the lower end of the external malleolus. Another method is from the umbilicus to the internal condyle of the femur, or from the umbilicus down on the inside of the limb, around the foot and up on the outside to the superior spinous process of the ilium.

I myself have been in the habit of placing my patient, undressed, flat and straight upon the floor, and measure from umbilicus to internal malleolus, but believe that the method of placing the patient in an erect position, holding a plumb line from the cervical vertibræ, is the most correct, for the slightest variation from the spine will be indicated at once; several blocks of wood of different thickness, from one-eighth, one-fourth, one-half and one inch thick should be on hand, to be placed under the shortest foot as required, to make the body plumb; the height of the blocks will be the exact shortening and can be read off at once.

RESUME.

1st. That the long splint has been used since time immemorial; the inclined plane also, but that the latter is by far superior.

2nd. That no apparatus is perfect, and none answers for all cases, but all have their advantages and faults, more or less, and each may serve well in special cases.

3rd. That we will have more or less shortening in adults, no matter what the treatment may have been; shortening rarely happens in children, for the great and wise doctor, Nature, comes in time to our assistance and corrects our shortcomings.

4th. That it is not prudent to confine ourselves exclusively to one apparatus, but must admit that the surgeon who has had an extensive practice and experience with a particular apparatus will obtain better results with it, than he who applies it only occasionally.